ERRATA AND ADDITIONS TO THE FEBRUARY 4, 2003 WORKSHOP DRAFT OF THE 2005 BUILDING ENERGY EFFICIENCY STANDARDS

Standards for Residential and Nonresidential Buildings

Section 10-114 (c), page 16

(c) **Amending the Lighting Zone Designation**. A local jurisdiction may officially adopt changes to the lighting zone designation of an area by following a public process that allows for formal public notification, review, and comment about the proposed change. The local jurisdiction may determine areas where Lighting Zone 4 is applicable and may increase by or decrease the lighting zones for areas that are in State Default Lighting Zones 1, 2 and 3, as specified in TABLE 10-114-A.

Section 101 (b), page 39

TEMPORARY LIGHTING is a lighting installation where temporary connections, such as cord and plug, are used for electric power, and for which the installation shall not persist beyond 60 days nor more than 120 days per year.

Section 112, Table 112-H, page 49

In Table 112-C, the reference for table note "c" should appear in the column titled "Test Procedure."

Section 146 (c) 3 B ii, page 117

ii. For retail sales, determine the allowed general interior lighting power by multiplying the area of the space by 1.2 w/sf for rooms with RCR<3.5; by 1.4 w/sf for rooms with RCR between 3.5 and 7.0; and by 1.6 w/sf for rooms with RCR > 7.0. For all other tasks, specify an illumination category based on column 2 of TABLE 146-E, and then refer to TABLE 146-G to determine the allowed power based on RCR of the room.

Section 146, Table 146-D, page 122

In Table 146-D, the row "Financial Transactions" should be deleted.

Section 146, Table 146-E, page 123-125

TABLE 146-E TAILORED METHOD SPECIAL LIGHTING POWER ALLOWANCES

	1	2	3	4	5	6
Primary Function	Allowed Tailored Method	B Method Illumination Category	B Method Allowed Wall Display Power (W/ft)	Method Allowed General Display Power (W/ft²)	B Method Allowed Ornamental /Special Effect Lighting (Y or N)	B Method Allowed Very Valuable Display Power (W/sf)
Auditorium	B	D	-	0.4	0.6	-
Auto repair	A		-	-	-	-
Financial Transactions	A or B	D	3.5	.5	0.7	-
Civic facilities	A or B	D	3.5	.5	0.7	-
Classrooms, lecture, training, vocational room	A or B	D	7	-	-	-
Commercial and industrial storage	A		-	-	-	-

	1	2	3	4	5	6
Primary Function	Allowed Tailored Method	B Method Illumination Category	B Method Allowed Wall Display Power (W/ft)	Method Allowed General Display Power (W/ft²)	B Method Allowed Ornamental /Special Effect Lighting (Y or N)	B Method Allowed Very Valuable Display Power (W/sf)
Convention, conference, multipurpose and meeting centers	A or B	D	7	.5	0.7	
Corridors, restrooms, stairs and support areas	A		-	-	-	-
Dining	B	B	.6	.5	0.7	-
Electrical, mechanical rooms	A		-	-	-	-
Exercise center, gymnasium	A		-	-	-	-
Exhibit, museum	B	C	21.0	1.7	0.7	1.0
General commercial and industrial work:						
High bay	A		-	-	-	-
Low bay	A		-	-	-	-
Precision	A		-	-	-	-
Grocery store	B	D	15	1.2	0	-
Housing, Public and Commons Areas						
Multi-family	A		-	-	0.7	-
Dormitory, Senior Housing	A or B	D	-	-	0.7	-
Hotel function area	B	D	3.5	.5	0.7	-
Kitchen, food preparation	A		-	-	-	-
Laundry	A		-	-	-	-
Library						
Reading areas	A or B	D	-	-	0.7	-
Stacks	A		-	-	-	-
Lobbies:						
Hotel lobby	B	C	7	.2	0.7	-
Main entry lobby	B	C	7	.2	-	-
Reception/waiting	B	C	7	.2	0.7	-
Locker/dressing room	A		-	-	-	-
Lounge/recreation	B	C	7	-	0.7	-
Malls, arcades and atria	A or B	D	5	.8	0.7	-
Medical and clinical care	A		-	-	-	-
Office	A		-	-	-	-
Religious worship	B	D	7	.5	0.6	0.4
Retail merchandise sales, wholesale showrooms	B	See Section 146(3)(B)(ii)	21.0	1.8	0.7	1.0
Transportation facilities	A or B	D	3.5	-	0.7	-
Theaters:						
Motion picture	B	C	7	-	0.7	-
Performance	B	D	7	-	0.7	-
All other	A		-	-	-	-

Section 147 (d) 2 C, page 127

Add this to the end of 147 (d) 2 C:

For individual displays, the frontage shall be two times the actual width of the display as measured in plan parallel to the street, road, or sidewalk. Sales frontage shall be immediately adjacent to the principal viewing location and unobstructed for its viewing length. A corner sales lot may include both sides provided that there is a different principal viewing location exists for each side.

Section 151, Feb. 4 Workshop Draft page 150-151

TABLE 151-C ALTERNATIVE COMPONENT PACKAGE D

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
BUILDING ENVELOPE																
Insulation minimums[1]																
Ceiling	R38	R30	R30	R30	R30	R30	R30	R30	R30	R30	R38	R38	R38	R38	R38	R38
Wood-frame walls	R21	R13	R13	R13	R13	R13	R13	R13	R13	R13	R19	R19	R19	R21	R21	R21
"Heavy mass" walls	(R4.76)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R4.76)	(R4.76)	(R4.76)	(R4.76)	(R4.76)	(R4.76)
"Light mass" walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Below-grade walls	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R13
Slab floor perimeter	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	R7
Raised floors	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]	R19[1]
Concrete raised floors	R8	R8	R0	R0	R0	R0	R0	R0	R0	R0	R8	R4	R8	R8	R4	R8
Radiant Barrier	NR	REQ	NR	REQ	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
FENESTRATION																
Maximum U-factor[2]	0.57~~0.65~~	0.57~~0.65~~	0.67~~0.75~~	0.67~~0.75~~	0.67~~0.75~~	0.67~~0.75~~	0.67~~0.75~~	0.67~~0.75~~	0.67~~0.75~~	0.57~~0.65~~	0.57~~0.65~~	0.57~~0.65~~	0.57~~0.65~~	0.57~~0.65~~	0.57~~0.65~~	0.35~~0.60~~
Maximum Solar Heat Gain Coefficient (SHGC)[3]	NR	0.37~~0.40~~	NR	0.37~~0.40~~	NR	NR	0.37~~0.40~~	0.37~~0.40~~	0.37~~0.40~~	0.37~~0.40~~	0.37~~0.40~~	0.37~~0.40~~	0.37~~0.40~~	0.37~~0.40~~	0.37~~0.40~~	NR
Maximum total area	20%~~16%~~	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Maximum West facing area	NR	5%~~16%~~	NR	5%	NR~~16%~~	NR	5%	5%	5%	5%	5%~~16%~~	5%~~16%~~	5%~~16%~~	5%~~16%~~	5%~~16%~~	NR~~16%~~
THERMAL MASS[4]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SPACE-HEATING SYSTEM[5]																
Electric-resistant allowed	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
If gas, AFUE =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
If heat pump, split system HSPF~~76~~ =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
Single package system HSPF =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
SPACE-COOLING																

SYSTEM																
If split system A/C, SEER =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
Refrigerant charge measurement or Thermostatic Expansion valve	NR	REQ[A2]	NR	NR	NR	NR	NR	REQ[A2]	REQ[A2]	REQ[A5]	REQ[A5]	REQ[A5]	REQ[A6]	REQ[A7]	REQ	NR
If single package A/C, SEER =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
SPACE CONDITIONING DUCTS																
Duct sealing	REQ[A1]	REQ[A2]	REQ[A3]	REQ[A4]	REQ[A3]	REQ[A3]	REQ[A3]	REQ[A2]	REQ[A2]	REQ[A5]	REQ[A5]	REQ[A5]	REQ[A6]	REQ[A7]	REQ	REQ[A1]
Duct Insulation	R-8	R-8	R-8	R-8	R-8	R-4.2	R-4.2	R-4.2	R-4.2	R-8	R-8	R-8	R-8	R-8	R-8	R-8
DOMESTIC WATER-HEATING TYPE																
System must meet budget, see Section 151 (b) 1 and (f) 8	Any[8]	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any

NOTES TO TABLE 151-B and TABLE 151-C ALTERNATIVE COMPONENT PACKAGE ~~NOTES TO THE LOW-RISE RESIDENTIAL PACKAGES IN TABLES 1-Z1 THROUGH 1-Z16~~

~~1 Package C is the only package that allows electric resistance space heating. Package C may be used only if the building is in an area (1) where natural gas is not currently available and (2) where extension of natural gas service is impractical, as determined by the natural gas utility. Package D allows more glazing area in some zones with moderately high insulation levels; slab edge insulation is required in Climate Zone 16.~~

~~2~~1 The R-values shown for ceiling, wood frame wall and raised floor are for wood-frame construction with insulation installed between the framing members. For alternative construction assemblies, see Section 151 (f) 1 A.

The heavy mass wall R-value in parentheses is the minimum R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The light mass wall R-value in brackets is the minimum R-value for the entire assembly if the heat capacity of the wall meets or exceeds the result of multiplying the bracketed minimum R-value by 0.65. Any insulation installed on heavy or light mass walls must be integral with, or installed on the outside of, the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the thermal mass requirement.

~~3 For glazing U-factor rating procedures and labeling requirements see Section 116 (a) 2.~~

2 The installed fenestration products shall meet the requirements of Section 151 (f) 3

3 The installed fenestration products shall meet the requirements of Section 151 (f) 4

4 If the package requires thermal mass, meet the requirements of Section 151 (f) 5.

5 Automatic setback thermostats must be installed in conjunction with all space-heating systems in accordance with Section 151 (f) 9.

~~6 Ducts in Package C shall be insulated to an installed value of at least R-8.~~

6 HSPF means "heating seasonal performance factor."

7 Electric-resistance water heating is allowed as the main water heating source in Package C only if the water heater is located within the building envelope and a minimum of 25 percent of the energy for water heating is provided by a passive or active solar system or a wood stove boiler. The wood stove boiler credit is not allowed in Climate Zones 8, 10, and 15, nor in localities that do not allow wood stoves.

A1 As an alternative under Package D, glazing with a maximum 0.42 U-factor and a 90% AFUE furnace or a 7.6 HSPF heat pump may be substituted for duct sealing. All other requirements of Package D must be met.

A2 As an alternative under Package D, glazing with a maximum 0.38 U-factor and maximum 0.31 SHGC may be substituted for duct sealing and either refrigerant charge measurement or a thermostatic expansion valve. All other requirements of Package D must be met.

A3 As an alternative under Package D, glazing with a maximum 0.42 U-factor may be substituted for duct sealing. All other requirements of Package D must be met.

A4 As an alternative under Package D, glazing with a maximum 0.38 U-factor and maximum 0.36 Solar Heat Gain Coefficient may be substituted for duct sealing. All other requirements of Package D must be met.

A5 As an alternative under Package D, glazing with a maximum 0.38 U-factor and maximum 0.31 Solar Heat Gain Coefficient, and a minimum 13.0 SEER space cooling system may be substituted for duct sealing and either refrigerant charge measurement or a thermostatic expansion valve. All other requirements of Package D must be met.

A6 As an alternative under Package D, glazing with a maximum 0.38 U-factor and maximum 0.31 Solar Heat Gain Coefficient, and a minimum 15.0 SEER space cooling system may be substituted for duct sealing and either refrigerant charge measurement or a thermostatic expansion valve. All other requirements of Package D must be met.

A7 As an alternative under Package D, glazing with a maximum 0.38 U-factor and maximum 0.31 Solar Heat Gain Coefficient, and a minimum 16.0 SEER space cooling system may be substituted for duct sealing and either refrigerant charge measurement or a thermostatic expansion valve. All other requirements of Package D must be met.

NOTE: Authority cited: Public Resources Code, Sections 25218(e), 25402, and 25402.1. Reference: Public Resources Code, Section 25402

Nonresidential ACM Manual

Chapter 2, page 2-120

2.4.2.36 HVAC Transport Efficiency

Description: ACMs shall be able calculate the ratio between the energy expended to transport heating, cooling and ventilation throughout the building, and the total thermal energy delivered to the various zones in the building.

Modeling Rules: The transport energy includes all distribution-fan, ventilation-fan and non-DHW pump consumption, and the thermal energy delivered is the sum of all zone loads. This ratio must be calculated both over the course of the year, and under design conditions.

TE = (distribution fan energy + ventilation fan energy + non-DHW pump energy)/(total thermal load)

Residential ACM Manual

Chapter 4, page 4-29

Under "Fan Energy for Cooling", note the change in the definition of "FanW/Btu":

FanW/Btu = Fan watts per Btu of rated cooling capacity. This defaults to 0.015 W/Btu. The default value shall be used for the Standard design. Alternate FanW/Btu may be used in ACM calculations for the Proposed design if the actual installed fan watts are less than or equal to the simulation value based on measurements certified by the installer and verified by a rater using the procedure in Appendix __.

ACM RM-2005, Section RM 4.2, page RM-5

Equation RM2

Standard Total Electrical Input (W) =
0.1048 (W/Btu/hr) x Design Cooling Capacity (Btu/hr)

ACM RM-2005, Section RM 4.3, page RM-5

The following replaces the current text:

RM4.3 Proposed Compressor Electrical Input

The proposed electrical input (W) for the installed cooling system is calculated as follows:

Proposed Compressor Electrical Input (W) =
Electrical Input (W) - (.0122 * Design Cooling Capacity (Btu/hr)) Equation RM3

Where "Electrical Input" is as published in the Directories of Certified Appliances maintained by the California Energy Commission in accordance with the requirements of the Appliance Standards.

Updates to ACM RQ-2005 and the new appendix, ACM RR-2005, appear in the following pages.

ACM RQ-2005

Appendix RQ – High Quality Insulation Installation Procedures

NOTE: THIS IS AN ENTIRELY NEW APPENDIX. MARKED CHANGES ARE RELATIVE TO THE NOVEMBER WORKSHOP DRAFT.

RQ1. Purpose and Scope

ACM RQ is a procedure for verifying the quality of insulation installation in low-rise residential buildings. A compliance credit is offered when this procedure is followed by the insulation installer and a qualified HERS rater. The procedure and credit applies to wood framed construction with wall stud cavities, ceilings, and roof assemblies insulated with mineral fiber or cellulose insulation in low-rise residential buildings.

RQ2. Terminology

Air Barrier An air barrier is ~~required~~ needed in all thermal envelope assemblies to prevent air movement. Insulation, other than foam, is not designed to stop air movement. For insulation installed horizontally, such as in an attic, the insulation must be in substantial contact with the assembly air barrier (usually the ceiling drywall) on one side for it to perform at its rated R-value. A wall or ceiling covering that has multiple leakage sites (such as a 1 x 6 tongue and grove board ceilings) can not serve as an air barrier.

Air-tight Thermal envelope assemblies (such as wall assemblies) shall be built to minimize air movement. Air movement can move unwanted heat and moisture through or into the assembly. For these procedures air-tight shall be defined as an assembly or air barrier with all openings greater than 1/8 inch~~.~~ caulked, or sealed with expansive or minimally expansive foam.

Excessive Compression Batt insulation may be compressed up to 50% at obstructions such as plumbing vents and in non-standard cavities, but compression of more than 50% in any dimension is excessive and shall not be allowed. ~~.~~ Where obstructions would cause the insulation to be compressed greater than 50% insulation shall be cut to fit around the obstruction.

Delaminated Batts are often split or delaminated to fit around an obstruction. For example when an electrical wire runs through a wall cavity the insulation must still fill the area both in front of the wire and the area behind the wire. This is typically accomplished by delaminating the batt from one end and placing one side of the batt behind the wire and the other in front of the wire. The location of the delamination must coincide with the location of the obstruction. For example if the wire is one third of the distance from the front of the cavity the batt should be delaminated so that two thirds of the batt goes behind the wire and one third in front of the wire.

Draft Stops Draft stops are installed to prevent air movement between wall cavities, other interstitial cavities - and the attic. They are typically constructed of dimensional lumber blocking, drywall or plywood. Draft stops become part of the attic ~~insulation~~ air barrier and shall be air-tight. Fire ~~stops~~ blocks constructed of ~~mineral fiber~~ porous insulation materials cannot serve as draft stops since they are not air-tight.

Friction Fit Friction fit batts are commonly used. Friction fit batts have enough side-to-side frictional force to hold the batt in place without any other means of attachment.

Gaps A gap is an uninsulated area at the edge of or between batts. Gaps in insulation are avoidable and are not permitted.

Hard Covers Hard covers shall be installed above areas where there is a drop ceiling. For example a home with 10 ft ceilings may have an entry closet with a ceiling lowered to 8 ft. A hard cover (usually a piece of plywood) is installed at the 10 ft. level above the entry closet. Hard covers become part of the ceiling air barrier and shall be ~~substantially~~ air-tight.

Inset Stapling In windy areas installers often staple the flanges of faced batts to the sides of the stud in order to assure that the insulation remains in place ~~till~~ until covered with drywall, particularly on the wall between the house and the garage where there isn't any exterior sheathing to help keep the insulation in place. The void created by the flange inset shall not extend more than two inches from the stud on each side.

Net Free-Area The net free-area of a vent cover is equal to the total vent opening less the interference to air flow caused by the screen or louver. Screened or louvered vent opening covers are typically marked by the manufacturer with the "net free-area." For example a 22.5 in. by 3.5 in. eave vent screen with a total area of 78.75 square inches may have a net free-area of only 45 square inches.

Voids When batt insulation is pushed too far into a wall stud cavity a void is created between the front of the batt and the drywall. Batts shall be fully lofted and fill the cavity front-to-back. Voids are also created when pieces of Small voids less than ¾ in. deep on the front or back of a batt shall be allowed as long as the total void area is not over 10% of the batt surface area. This definition shall not preclude the practice of inset stapling as long as the void created by the flange inset meets the specification in the definition of inset stapling.

RQ3. Raised Floors and Floors Over Garages

- Batts shall be correctly sized to fit snugly at the sides and ends, but not be so large as to buckle.
- Batts shall be cut to fit properly without gaps. Insulation shall not be doubled-over or compressed.
- Insulation shall be in contact with an air barrier - usually the subfloor.
- On floors that are over garages, or where there is an air space between the insulation and the subfloor, the rim joist shall be insulated.
- Batts shall be cut to butt-fit around wiring and plumbing, or be split (delaminated) so that one layer can fit behind the wiring or plumbing, and one layer fit in front.
- If the insulation is faced, the facing shall be placed toward the living space.
- Insulation shall be properly supported to avoid gaps, voids, and compression.

RQ4. Wall Insulation

RQ4.1. Batt Installation

- Wall stud cavities shall be caulked or ~~foamed to~~foamed to provide a substantially air-tight envelope to the outdoors, attic, garage and crawl space. Special attention shall be paid to plumbing and wiring penetrations through the top plates, electrical boxes that penetrate the sheathing, and the sheathing seal to the bottom plate.
- Installation shall uniformly fill the cavity side-to-side, top-to-bottom, and front-to-back.
- The batt shall be friction fitted into the cavity unless another support method is used
- Batt insulation shall be installed to fill the cavity and be in contact with the sheathing on the back and the wallboard on the front - no gaps or voids.
- Batts with flanges that are inset stapled to the side of the stud must be flush with the face of the cavity (or protrude beyond) except for the portion that is less than two inches from the edge of the stud.
- Non-standard-width cavities shall be filled with batt insulation snuggly fitted into the space without excessive compression.
- Batt insulation shall be cut to butt-fit around wiring and plumbing, or be split (delaminated) so that one layer can fit behind the wiring or plumbing, and one layer fit in front.

RQ4.2 Narrow-Framed Cavities

- Non-standard width cavities shall be filled by batt insulation cut to snuggly fit into the space.

- Narrow spaces (two inches or less) at windows, between studs at the building's corners, and at the intersections of partition walls shall be filled with~~;~~ batt insulation snuggly fitted into the space (without excessive compression), loose fill insulation, or expansive or minimally expansive foam.

RQ4.3 Special Situations

RQ4.3.1 Installations Prior to Exterior Sheathing or Lath

- Hard to access wall stud cavities such as; corner channels, ~~partition~~ wall intersections, and behind tub/shower enclosures shall be insulated to the proper R-value. This may have to be done prior to the installation of the exterior sheathing or the stucco lath.

RQ4.3.2 Obstructions

- Insulation shall be cut to fit around wiring and plumbing without compression.
- Insulation shall be placed between the sheathing and the rear of electrical boxes and phone boxes.
- In cold climates, where water pipes may freeze (Climate Zones 14 and 16) pipes shall have at least two-thirds of the insulation between the water pipe and the outside. If the pipe is near the outside, as much insulation as possible shall be placed ~~behind~~between the pipe and the outside (without excessive compression), and no insulation shall be placed between the pipe and the inside.

RQ4.3.3 Rim Joists

- All rim-joists shall be insulated to the same R-Value as the adjacent walls.
- The insulation shall be installed without gaps or excessive compression.

RQ4.3.4 Kneewalls and Skylight Shafts

- All kneewalls and skylight shafts shall be insulated to a minimum of R-19.
- The insulation shall be installed without gaps and with minimal compression.
- For steel-framed kneewalls and skylight shafts, external surfaces of steel studs must be covered with batts or rigid foam unless otherwise specified on the CF-1R and documented by a form 3R generated by EZFRAME.
- The house side of the insulation shall be in contact with the drywall or other wall finish.
- The insulation shall be supported so that it will not fall down by either fitting to the framing, stapling in place with minimal compression, or using other support such as netting.

RQ4.3.5 HVAC/Plumbing Closet

- Walls of interior closets for HVAC and/or water heating equipment, that require combustion air venting, shall be insulated to the same R-value as the exterior walls.

RQ4.3.6 Loose Fill Wall Insulation

- Wall stud cavities shall be caulked or foamed to provide a substantially air-tight envelope to the outdoors, attic, garage and crawl space. Special attention shall be paid to plumbing and wiring penetrations through the top plates, electrical boxes that penetrate the sheathing, and the sheathing seal to the bottom plate.
- Installation shall uniformly fill the cavity side-to-side, top-to-bottom, and front-to-back.
- Loose fill insulation shall be installed to fill the cavity and be in contact with the sheathing on the back and the wallboard on the front - no gaps or voids.
- Loose fill wall insulation shall be installed to fit around wiring, plumbing, and other obstructions.
- The installer shall certify on forms CF-6R and IC-1~~installed density shall be measured by both the insulation installer and the HERS rater to assure~~ that the manufacturer's minimum ~~density~~weight-per-square-foot requirement has been met.

~~□The insulation installer shall take one density measurement. The measurement shall be recorded on the CF-6R. Note: In order to receive compliance credit the installed density must be verified by the HERS rater.~~

~~□The HERS rater shall take one measurement for every 400 square feet of wall area or three measurements, whichever is greater. The rater shall repair the wall insulation at the sample locations. The rater shall record only the lowest density measurement on the CF-4R.~~

~~□Measurements shall be taken in accordance with Insulation Contractors Association of America (ICAA) Technical Bulletin No 17: Evaluation of Installed Loose Fill Attic Insulation. Loose fill insulation that has been installed with water added shall have its weight adjusted for the measured moisture content. A moisture meter shall be used to determine the percent moisture content of the sample before the sample is removed form the wall cavity. The wet sample weight shall be adjusted, using the equation shown below, to provide the air-dry sample weight.~~

~~$Sample\ Weight_{air\text{-}dry} = (Weight_{wet\text{-}sample} * 1.08) / ((Moisture\ Content\ \% / 100) + 1)$ Equation RQ1~~

RQ5. Ceiling and Roof Insulation

RQ5.1 Batt Insulation

RQ5.1.1 General Requirements

- Batts shall be correctly sized to fit snugly at the sides and ends.
- Batts shall be installed so that they will be in contact with the air barrier.
- Where necessary, batts shall be cut to fit properly - there shall be no gaps, nor shall the insulation be doubled-over or compressed.
- When batts are cut to fit a non-standard cavity, they shall be snuggly fitted to fill the cavity <u>without excessive compression</u>.
- Batts shall be cut to butt-fit around wiring and plumbing, or be split (delaminated) so that one layer can fit behind the wiring or plumbing, and one layer fit in front.
- For batts that are taller than the trusses, full-width batts shall be used so that they expand to touch each other over the trusses.
- Hard covers or draft stops shall be placed over all drop ceiling areas and interior wall cavities to keep insulation in place and stop air movement. If hard covers or draft stops are missing or incomplete, they shall be completed before insulation is installed.
- Required eave ventilation shall not be obstructed - the net free-ventilation area of the eave vent shall be maintained.
- <u>Eave vent baffles shall be installed to prevent air movement under or into the batt.</u>
- Insulation shall cover all IC rated lighting fixtures.
- Fixtures that are not IC rated (e.g., halogen lamps, heat lamps) shall ~~to~~ be <u>completely</u> enclosed in an airtight box that meets fire codes, and the box covered with <u>a minimum of R-19</u> insulation. If fixtures are not IC rated and not enclosed in such a box, they shall be replaced or boxed before insulation is installed.

RQ5.1.2 Special Situations

RQ5.1.2.1 Rafter Ceilings

- An air space shall be maintained between the insulation and roof sheathing if ~~necessary to meet local codes~~ <u>required by California Building Code section 1505.3</u>.
- Facings and insulation shall be kept away from combustion appliance flues in accordance with flue manufacturers' installation instructions or labels on the flue.

RQ5.1.2.2 HVAC Platform

- AVerify that the appropriate batt insulation shall beis placed below any plywood platform or cat-walks for HVAC equipment installation and access
- Batts shall be installed so that they will be in contact with the air barrier.

RQ5.1.2.3 *Attic* Access

- Permanently attach rigid foam or a batt of insulation to the access doorcover using adhesive or mechanical fastener.

RQ5.2. Blown-InLoose-Fill Ceiling Insulation

RQ5.2.1 General Requirements

- Baffles shall be placed at eaves or soffit vents to keep insulation from blocking eave ventilation. The required net free-ventilation shall be maintained.
- Eave vent baffles shall be installed to prevent air movement under or into the loose-fill insulation.
- Hard covers or draft stops shall be placed over all drop ceiling areas and interior wall cavities to keep insulation in place and stop air movement. If hard covers or draft stops are missing or incomplete, they shall be completed before insulation is completed or the entire drop area shall be filled with blown-inloose-fill insulation level with the rest of the attic.
- Attic rulers appropriate to the material installed shall be evenly distributedplaced around throughout the attic to verify depth: one ruler for every 250 square feet, evenly distributed around throughout the attic and clearly readable from the attic access. The rulers shall be scaled to read inches of insulation orand the R-value installed. Attic rulers shall show the manufacturer's minimum required thickness at time of installation and the minimum required settled thickness.

- Insulation shall be blown to a uniform thickness throughout the attic with all areas meeting or exceeding the insulation manufacturer's minimum requirements for depth and density

- Insulation shall go be applied underneath and on both sides of obstructions such as cross-bracing and wiring.
- Insulation shall be applied all the way to the outer edge of the wall top plate.
- Insulation shall cover IC-rated lighting fixtures.
- Fixtures that are not IC rated (e.g., halogen lamps, heat lamps) shall to be completely enclosed in an airtight box that meets fire codes, and the box covered with a minimum of R-19 insulation. If fixtures are not IC rated and not enclosed in such a box, they shall be replaced or boxed before insulation is completed.
- Insulation shall be kept away from combustion appliance flues in accordance with flue manufacturer's installation instructions or labels on the flue.
- Insulation shall be blown to a uniform thickness throughout the attic with all areas meeting or exceeding the insulation manufacturer's minimum requirements for depth and weight-per-square-foot. nn
- The installer shall certify on forms CF-6R and IC-1d weight-per-square-foot shall be measured by both the insulation installer and the HERS rater to assure that the manufacturer's minimum weight-per-square-foot requirement has been met.
- The HERS rater shall verify that the manufacturer's minimum weight-per-square-foot requirement has been met for attics insulated with on all loose- fill mineral-fiber attics insulation. One attic sample shall be taken in the area that appears to have the least amount of insulation. The rater shall record the weight-per-square-foot of the sample on the CF-4R.
- The HERS rater shall verify that the manufacturer's minimum insulation thickness has been installed., For cellulose insulation this verification shall takeing into account the time that has elapsed since the insulation was installed. If the insulation has been in place less than seven days, the insulation shall be within 1/2

inch of the manufacturer's minimum required thickness at the time of installation (or greater). ~~(or greater) shall be in place.~~ If the insulation has been in place for seven days or longer, the manufacturer's minimum required settled thickness (or greater) shall be in place.

- ~~The insulation installer shall take one weight measurement. The measurement shall be recorded on the CF-6R. Note: In order to receive compliance credit the installed weight must be verified by the HERS rater.~~

~~□The HERS rater shall take one weight measurement for every 400 square feet of ceiling area or three measurements, whichever is greater. The rater shall repair the ceiling insulation at the sample locations. The rater shall make every effort not to disturb the insulation except where the samples are taken. One sample shall be taken in the area that appears to have the least amount of insulation. The rater shall record only the lowest weight-per-square-foot measurement on the CF-4R.~~

~~□Measurements shall be taken in accordance with Insulation Contractors Association of America (ICAA) Technical Bulletin No 17: Evaluation of Installed Loose-Fill Attic Insulation. Loose fill insulation that has been installed with water added shall have its weight adjusted for the measured moisture content. A moisture meter shall be used to determine the percent moisture content of the sample before the sample is removed for weighing. The wet sample weight shall be adjusted, using the equation shown below, to provide the air-dry sample weight.~~

~~$\text{Sample Weight}_{\text{air-dry}} = (\text{Weight}_{\text{wet-sample}} * 1.08) / ((\text{Moisture Content \%} / 100) + 1)$ Equation RQ2~~

RQ5.2.2 Special Situations

RQ5.2.2.1 Kneewalls and Skylight Shafts:

- Kneewalls and skylight shafts shall be insulated to a minimum of R-19. If loose fill insulation is used it shall be properly supported with netting or other support material.

RQ5.2.2.2 HVAC Platform

- Pressure-fill the areas under any plywood platform or walks for HVAC equipment installation and access or verify that appropriate batt insulation has been installed.

RQ5.2.2.3 Attic Access

~~□Permanently attach rigid foam or a batt of insulation that is equal or exceeds the R-value of the insulation on the attic floor to the access cover using adhesive or mechanical fastener.~~

~~□~~Permanently attach rigid foam or a batt of insulation to the access door using adhesive or mechanical fastener.

~~□~~*RQ~~7~~6. Materials*

- Materials shall comply with Uniform Building Code (including, but not limited to, 1997 UBC Section 707) and installed to meet all applicable fire codes.
- Materials shall meet California Quality Standards for Insulating Material, Title 24, Chapter 4, Article 3, listed in the California Department of Consumer Affairs Consumer Guide and Directory of Certified Insulating Materials.
- Materials shall comply with flame spread rating and smoke density requirements of Sections 2602 and 707 of the Title 24, Part 2: all installations with exposed facings must use fire retardant facings which have been tested and certified not to exceed a flame spread of 25 and a smoke development rating of 450. Insulation facings that do not touch a ceiling, wall, or floor surface, and faced batts on the undersides of roofs with an air space between the ceiling and facing are considered exposed applications.
- Materials shall be installed according to manufacturer specifications and instructions.

RQ~~8~~7. Equipment

~~□Moisture meter - The moisture meter used to measure the moisture content of insulation shall be a resistance type with contact pins that are a minimum of three inches long. The meter shall be calibrated to a standard wood test specimen and be capable of reading to at least 40% moisture content. The meter shall be calibrated in accordance with the manufacturer's instructions.~~

- Scales - The scales used to weigh density samples shall be accurate to within +/- 0.03~~05~~ pounds. Scales shall be calibrated in accordance with manufacture's instructions.

RQ~~9~~8. R-Value and U-Value Specifications

See CF-1R for minimum R-value requirements; for non-standard assemblies, also see applicable form 3R.

RQ~~10~~9. *Certificates*

An Insulation Certificate (IC-1) signed by the insulation installer shall be provided that states that the installation is consistent with the plans and specifications for which the building permit was issued. The certificate shall also state the installing company name, insulation manufacturer's name and material identification, the installed R-value, and, in applications of ~~blown-in~~loose fill insulation, the minimum installed weight-per-square-foot ~~where required~~ (or the minimum weight per cubic foot) consistent with the manufacturer's labeled installed-design-density for the desired R-Value, and the number of inches required to achieve the desired R-Value. The insulation installer shall also complete a form CF-6R and attach a bag label or a manufacturer's coverage chart for every insulation material used.

RQ~~11~~10. Certificate Availability

The Insulation Certificate (IC-1) and Installation Certificate (CF-6R, with insulation material bag labels or coverage charts attached), signed by the insulation installer, shall be available on the building site for each of the HERS rater's verification inspections. Note: The HERS rater cannot verify compliance credit without these completed forms.

CF-6R & CF-4R Insulation Installation Quality Certificate

NOTE: THE FOLLOWING FORM IS PROVIDED FOR INFORMATION. IT WILL LIKELY BE INCLUDED IN THE RESIDENTIAL CONSERVATION MANUAL AND NOT IN THE ACM MANUAL.

Site Address_____ Permit _____

□ Installation meets all applicable requirements as specified in the Insulation Installation Procedures

(CF-6R only)

□ Insulation certificate, (IC-1) signed by the installer stating: insulation manufacturer's name, material identification, installed R-values, and for ~~blown-in~~loose-fill insulation: minimum weight per square foot and minimum inches

□ Installation Certificate, (CF-6R) signed by the installer certifying that the installation meets all applicable requirements as specified in the Insulation Installation Procedures

(CF-4R only)

1. FLOOR

□ All floor joist cavity insulation installed to uniformly fit the cavity side-to-side and end-to-end

□ Insulation in contact with the subfloor or rim joists insulated

□ Insulation properly supported to avoid gaps, voids, and compression

2. WALLS

- ☐ Wall stud cavities caulked or foamed to provide an air tight envelope
- ☐ Wall stud cavity insulation uniformly fills the cavity side-to-side, top-to-bottom, and front-to-back
- ☐ No gaps
- ☐ No voids over 3/4" deep or more than 10% of the batt surface area~~.~~
- ☐ Hard to access wall stud cavities such as; corner channels, wall intersections, and behind tub/shower enclosures insulated to proper R-Value
- ☐ Small spaces filled
- ☐ Rim-joists insulated
- ☐ Loose fill wall insulation meets or exceeds manufacturer's minimum ~~density~~weight-per-square-foot requirement~~. Sample density _____ (pounds per cubic foot - air dry or pounds per square foot - air dry). Manufacturer's minimum required density~~weight-per-square-foot _____ (pounds per cubic foot or pounds per square foot). Note: In order to receive compliance credit the HERS rater shall verify that the manufacturer's minimum density has been achieved.~~ (CF-6R only)

~~☐ Loose fill wall insulation meets or exceeds manufacturer's minimum density requirement. Record only lightest sample. Sample density _____ (pounds per cubic foot - air dry or pounds per square foot - air dry). Manufacturer's minimum required density _____ (pounds per cubic foot or pounds per square foot). (CF-4R only)~~

3. Roof/CEILING PREPARATION

- ☐ All draft stops in place to form a continuous ceiling and wall air barrier
- ☐ All drops covered with air-tight hard covers
- ☐ Floor cavities on multiple-story buildings have air tight draft stops to all adjoining attics
- ☐ Eave vents prepared for blown insulation - maintain net free-ventilation area
- ☐ Kneewalls insulated or prepared for blown insulation
- ☐ Area under equipment platforms and cat-walks insulated or accessible for blown insulation
- ☐ Attic rulers installed

4. Roof/CEILING BATTS

- ☐ No gaps
- ☐ No voids over ¾ in. deep or more than 10% of the batt surface area.
- ☐ Insulation in contact with the air-barrier
- ☐ Net free-ventilation area maintained at eave vents

5. Roof/CEILING ~~BLOWN-IN~~LOOSE-FILL

- ☐ Insulation uniformly covers the entire ceiling (or roof) area from the outside of all exterior walls.
- ☐ Baffles installed at eaves vents or soffit vents - maintain net free-ventilation area of eave vent
- ☐ Attic access insulated
- ☐ IC-rated recessed light fixtures covered
- ☐ Insulation at proper depth – insulation rulers visible and indicating proper depth and R-value
- ☐ ~~☐~~ Loose-fill ~~ceiling~~ insulation meets or exceeds manufacturer's minimum weight and thickness

requirements for the target R-value. Target R-value _____ Manufacturer's minimum required weight for the target R-value _____ (pounds per square foot). ~~Sample weight _____ (pounds per square foot - air dry).~~ Manufacturer's minimum required thickness at time of installation _____ Manufacturer's minimum required settled thickness _____ Note: In order to receive compliance credit the HERS rater shall verify that the manufacturer's minimum weight and thickness has been achieved for the target R-value (CF-6R only)

☐ ~~. (CF-6R only)~~ Loose-fill ~~attic~~ insulation installation date _____ (CF-6R only)

☐ ~~☐~~ Loose-fill mineral fiber ~~ceiling~~ insulation meets or exceeds manufacturer's minimum weight and thickness requirement for the target R-value. ~~Record only lightest sample.~~ Target R-value _____ Manufacturer's minimum required weight for the target R-value _____ (pounds per square foot). Sample weight _____ (pounds per square foot ~~- air dry~~) (CF-4R only)

☐ ~~.~~ Manufacturer's minimum required thickness at time of installation _____ (inches) Manufacturer's minimum required settled thickness _____ (inches). Number of days since loose-fill ~~attic ceiling~~ insulation was installed _____ (days). If the loose-fill ~~attic ceiling~~ insulation has been in place less than seven days the thickness shall be within 1/2 inch of the manufacturer's minimum required thickness at the time of installation (or greater). If the insulation has been ~~installed~~ in place for seven days or longer the manufacturer's minimum required settled thickness (or greater) shall be in place. Minimum thickness measured _____ (inches). (CF-4R only)

DECLARATION

I hereby certify that the installation meets all applicable requirements as specified in the Insulation Installation Procedures.

_____	_____	_____
Item #s	Signature, Date	Title, Company Name
_____	_____	_____
Item #s	Signature, Date	Title, Company Name
_____	_____	_____
Item #s	Signature, Date	Title, Company Name

ACM RR-2005

Appendix RR – Procedures for Verifying the Presence of a Thermostatic Expansion Valve or High Energy Efficiency Ratio Equipment

Note: This is an entirely new Appendix

RR1 Purpose and Scope

The purpose of these procedures are to verify that residential space cooling systems and heat pumps have the required components to achieve the energy efficiency claimed in the compliance documents. The procedures only apply when a TXV is specified or an EER higher than the default is claimed. For dwelling units with multiple systems, the procedures must be applied to each system separately.

The installer shall certify to the builder, building official and HERS rater that it has installed all the correct components.

The reference method algorithms adjust (improve) the efficiency of air conditioners and heat pumps when field verification indicates the specified components are installed. Table RR1 summarizes the algorithms that are affected.

TABLE RR1 – SUMMARY OF DIAGNOSTIC MEASUREMENTS

				Proposed Design	
Input to the Algorithms	Variables and Equation Reference	Description	Standard Design Value	Default Value	Procedure
Presence of a TXV	F_{TXV} (Eq. 4-42 and 4-43)	F_{TXV} is takes on a value of 0.96 when the system has a verified TXV or has been diagnostically tested for the correct refrigerant charge. Otherwise, F_{TXV} has a value of 0.90.	Split systems are assumed to have refrigerant charge testing or a TXV, when required by Package D.	No TXV or refrigerant charge testing.	RX2
Presence of a matched High Efficiency Compressor Unit, Evaporator Coil, Refrigerant Metering Device, and (where specified) Air Handling Unit and/or Time Delay Relay.	EER	The EER is the Energy Efficiency Ratio at 95 F outdoors specified according to ARI procedures for the matched combination	Systems are assumed to have the default EER based on SEER, see ACM Equation 4.44.	Default EER	RX 3 and RX4

RR2 TXV Verification Procedure

The procedure shall consist of visual verification that the TXV is installed on the system.

RR3 Time Delay Relay Verification Procedure

The procedure shall be:

1) Turn the thermostat down until the compressor and indoor fan are both running.

2) Turn the thermostat up so the compressor stops running.

3) Verify that the indoor fan continues to run for at least 30 seconds.

RR4 Matched Equipment Procedure

The procedure shall consist of visual verification of:

1) The specified make and model number of the outdoor unit.

2) The specified make and model number of the inside coil.

3) The specified make and model of the furnace or air handler when a specific furnace or air handler is specified to achieve the high efficiency rating,

4) The specified metering device when a specific refrigerant metering device (such as a TXV or an EXV) is specified to achieve the high efficiency rating.